HEWLETT PACKARD

BENCH BRIEFS

SERVICE INFORMATION FROM HEWLETT-PACKARD

MARCH/MAY 1985

Analog To-Digital Conversion

When an analog signal, either a voltage or a current, has to be expressed in digital form, the conversion is very often first done by transforming the analog signal into an analog time interval. The analog time interval, in turn, can be easily measured with a clock. The time displayed by the clock, when the clock period is correctly chosen, is also a digital expression of the analog value. Another way to do an analog-to-digital conversion (A/D conversion) is to increment or decrement a digitally controlled and known analog signal and to compare it with the analog signal to be digitized. At coincidence of both signals, the digital value of both signals is equal.

The sophistication of an A/D converter will depend on required performance such as:

- Accuracy
- Speed
- Noise Immunity
- Polarity Handling
- Dynamic Range

The reverse process is the digital-to-analog conversion (D/A conversion). A digital signal or multi-bit word has to produce an analog voltage or current. The design considerations for both D/A and A/D are very similar, except that the noise problem does not exist for the D/A conversion.

The Staircase Converter

Figure 1 illustrates a staircase A/D converter. The +V input is the analog signal to be digitized. A clock gives a start signal that causes a staircase ramp generator to begin to generate a 1 millivolt step with each clock pulse. Assume that the input = +5.753V. This voltage will be inverted by the impedance converter and then applied to the comparator. After 5753 clock pulses, the staircase ramp will have a value of +5753 mV. The comparator will detect the zero crossing at point A and will stop the clock. The display will indicate 5753 clock pulses, or, with a decimal point, a value of 5.753. The measurement resolution depends only on the magnitude of each staircase ramp step. For a higher resolution, each step could be 100 microvolts or less.

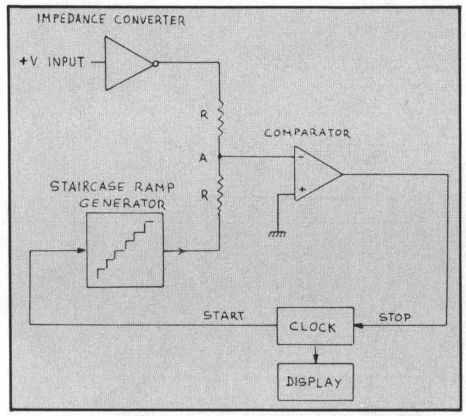


Figure 1. Simple staircase A/D converter.

The staircase converter cannot handle + and − inputs directly. Either a + and a − ramp must be generated, or one inverting and one non-inverting impedance converter must be provided in the input.

The most serious shortcomings of this type of A/D converter is its low conversion speed and sensitivity to noise. For example, assume that the dc voltage to be measured has an ac component, such as ripple from a power supply. As shown in Figure 2, coincidence of the input voltage value and staircase ramp will not always happen at the same level for each measurement. A difference between two measurements can be as high as the peak-to-peak value of the ripple voltage. A possible improvement would be to connect a low-pass filter in the signal input. However, such a filter would considerably reduce the speed at which measurements can be made.

Successive Approximation A/D Converter

If A/D conversions must be repeated at a fast rate, such as hundreds, or possibly thousands-per-second, the staircase converter would be too slow. For a 3½ digit display, the staircase converter may need up to 1999 clock pulses. The successive approximation A/D converter can do the same conversion with only 13 clock pulses. The basic principal in the successive approximation ADC is the unknown voltage (input) is compared to a sequence of known reference voltages developed by an internal digital-to-analog converter. The value of the comparison voltage at any step is dependent on the result of previous comparisons. Figure 3 illustrates the principal.

A Simple ADC

The comparison of the input voltage and the reference voltages, which are stepped in binary-coded-decimal (BCD) weighted voltage sets, is

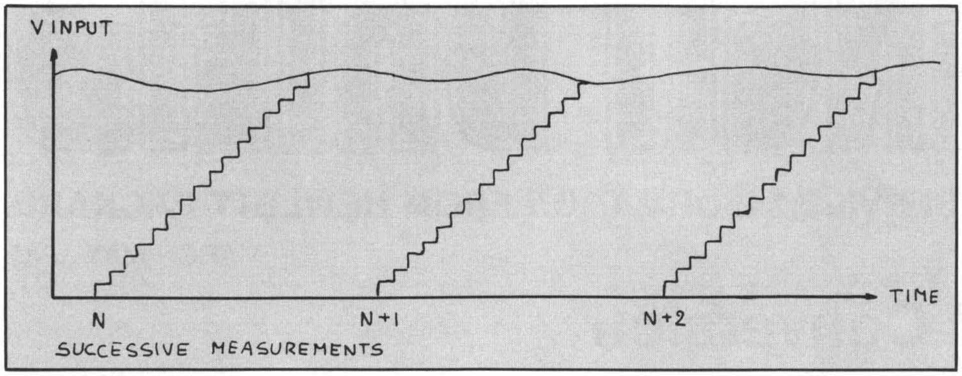


Figure 2. Effect of noise on successive measurements.

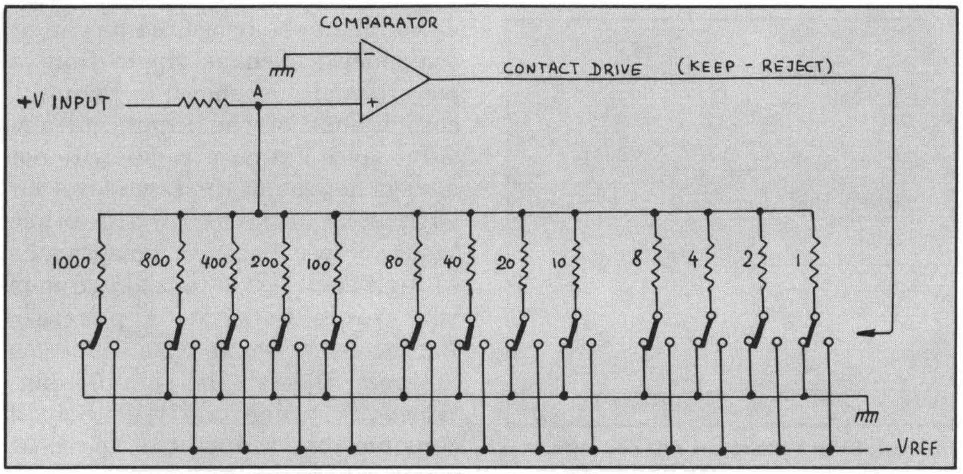


Figure 3. Successive approximation A/D converter (positive voltages only).

made at point A, which is also the input of a comparator. Each voltage set is generated in an 8,4,2,1 sequence and collectively represents a significant digit of the display. The output of the comparator drives the switches that turn the BCD voltage steps on or off. If the switched-in BCD level is more than the input, it is rejected and the next step is checked.

For example (refer to Figure 3), if the input voltage is 165.5 mV, the ADC first compares the input value with the 1000 mV step. Since the input value is lower, the 1000 mV step is rejected. The input is compared with the next step voltage, in this case 800 mV. The 800 mV step is also rejected for the same reason. This comparison and rejection is continued until the 100 mV step is compared. This comparison shows that the input is higher so the 100 mV step is saved. The next step voltage is now added to the 100 mV step just saved and compared with the input. The total of 100 mV and 80 mV is more than the input voltage, so the 80 mV step is rejected. Then the next step, now 40 mV, is added to the 100 mV previously kept and the new comparison is made at 140 mV.

The input voltage (165.5 mV) is more than the 140 mV so the 40 mV is also kept and now the reference is 140 mV. This process continues through steps 20 mV, 10 mV, 8 mV, etc.

The remaining approximation is easy to follow. Steps 100, 40, and 20 will remain switched on (100 + 40 + 20 = 160), then step 4, and finally step 1 mV (100+40+20+4+1=165). All other steps will be rejected. The display logic now checks which BCD steps have been retained and digitally expresses the value of the analog input.

The difference between the converted 165 mV and the known input of 165.5 mV is known as quantizing error. This error results because there is no combination of step voltages in this particular ADC that will yield the precise value, that is, the ADC cannot "resolve" the value of 0.5 mV. While another ADC with greater resolution could be used, it may not be as fast.

Effect of Noise

If there is noise on the input to the ADC, it will destroy the integrity of the reading. Any ripple voltage superimposed on the input will also produce a reading error. This tells us that we must hold the input voltage constant before making the analog-to-digital conversion: there must be a good sample and hold circuit in front of the ADC.

ADC With Sign Information

The previous example assumed a positive input voltage. In order to convert a negative voltage into a

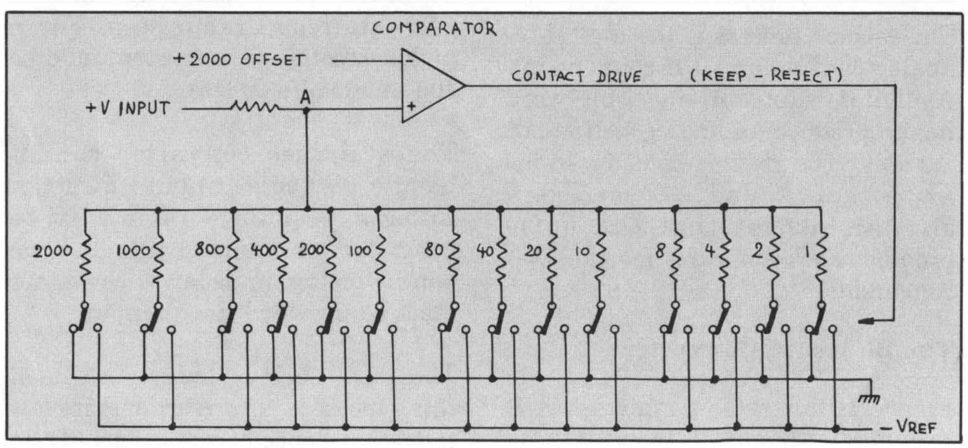


Figure 4. Successive approximation A/D converter with negative input capability.

digital code, a slight modification is made to the circuit. Figure 4 shows the modification.

First, an additional 2000 count step is added. Second the negative comparator input, instead of being connected to ground, is connected to a voltage that simulates a 2000 count offset. This 2000 count offset (½ full scale) causes a code of 2000 to correspond to analog zero and a code of all zeros to correspond to negative full scale (see Figure 5). This example is taken from the HP 3437A System Voltmeter. The 3437A is a 3-½ digit (4000 count) instrument, the highest display being ± 1998 or approximately 4000 counts.

The following description is loosely based on the HP 3437A System Voltmeter theory of operation. Much has been condensed, combined and reworded for brevity and simplicity.

A Zero Input Voltage

Assume that each count is the equivalent to 1 mV. The comparator has a +2000 mV offset (2000 counts) hardwired to its negative input. Therefore, with a 0V input at point A, the comparator output is positive and will switch on the highest BCD bit, which is −2000. The −2000 and the +2000 at the inputs of the comparator will offset its input to zero. This will tell the switching logic to keep the −2000 bit switched on. Switching on the next significant bit will make the output of the comparator negative, which will trigger a reject of this bit. This procedure will continue down to BCD step 1. All bits will be rejected except the −2000 BCD bit at the beginning. Since the instrument contains an algorithm that subtracts 2000 from the value of the retained BCD steps after the conversion, the sum is zero and so is the display.

A Positive Input Voltage

As an example, the input voltage at point A shall be +500 mV, which,

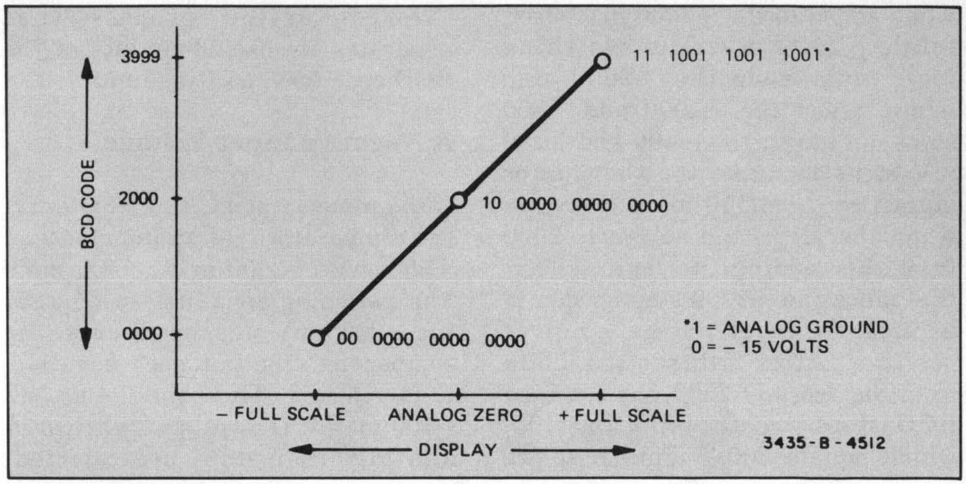
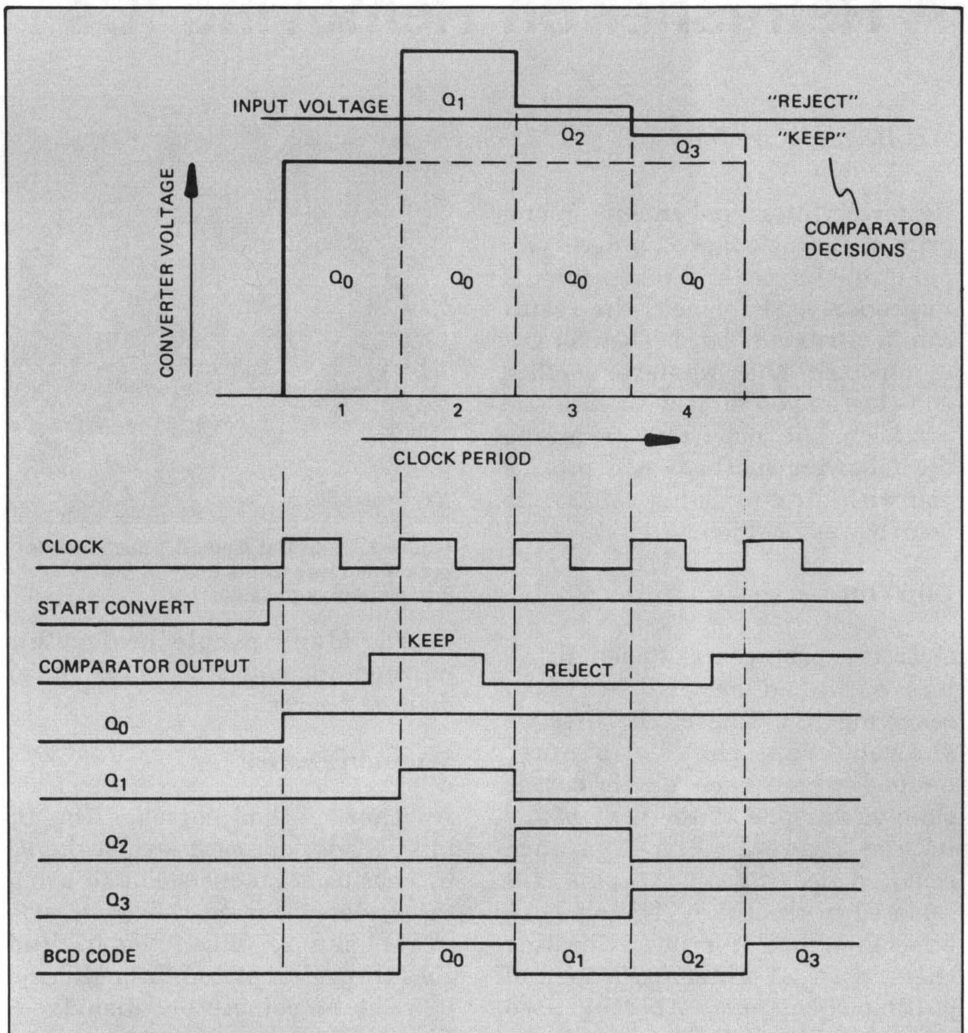


Figure 5. BCD code offset.



CLOCK PERIOD	REGISTER OUTPUT	COMPARATOR	BCD CODE Q0	Q1	Q2	Q3
1	Q0	KEEP	1			
2	Q0 + Q1	REJECT	1	0		
3	Q0 + Q2	REJECT	1	0	0	
4	Q0 + Q3	KEEP	1	0	0	1

Figure 6. BCD code generation.

when added to the +2000 mV offset, totals +2500 mV. The switching logic must keep the −2000 step (sign), reject the −1000 and −800 steps, and keep the −400 and −100 mV steps to make the comparator output zero (+2500 mV). However, when the algorithm subtracts 2000 from the reading, its logic tells it that since the −2000 step needed to be used, the input voltage is zero or positive. After subtracting 2000 from the original 2500, the retained BCD steps are the 400 and 100, which equals 500. Figure 6 shows the conversion process that generates the first four bits of the BCD code for a positive input.

A Negative Input Voltage

If the input at point A is −1500 mV, the comparator sees an imbalance of +500 mV (+2000 and −1500 mV). The switching logic first switches in the −2000 mV step, but because the comparator's output goes negative, it is rejected. Then the −400 and −100 mV BCD steps are switched in and all other steps are rejected. When the algorithm subtracts 2000 from the reading, its logic tells it that because the −2000 mV step was not used, the input voltage is negative and that the BCD reading (500) must be subtracted from 2000. The input voltage is, therefore, 2000-500 = 1500. The logic adds the negative sign because the BCD 2000 step was not needed to reach balance, so the reading is −1500. In all cases, that of zero input, plus input, or negative input, the digital reading is indicated by recording which BCD steps have been kept. □

A Refresher on Removing ICs

Jim Bechtold, Editor

Removing integrated circuits from a printed circuit board is a necessary part of the technician's job. If improperly performed, the result can be a ruined board. Therefore, it is important that whatever method you choose, you do it with care and precision. We hope that reviewing the following methods will provide you with an interesting solution to your IC removal job.

Clip Out

Over the past years, Bench Briefs has explored several ways of removing ICs. One of the first we showed was the "clip out" method–where each pin is cut as close as possible to the body of the IC (see Figure 1). The IC is then removed, leaving all the pins still soldered in the board. The pins can be removed one at a time by heating them with a soldering iron and pulling them out with long nose pliers (see Figure 2). Excess solder is cleared from the holes with an antistatic soldersucker.

Some service personnel regard the clip out method as crude, but it is very effective, easy to learn and there is minimal chance of overheating and damaging the PC board. Many people prefer this method for multilayer or other delicate boards.

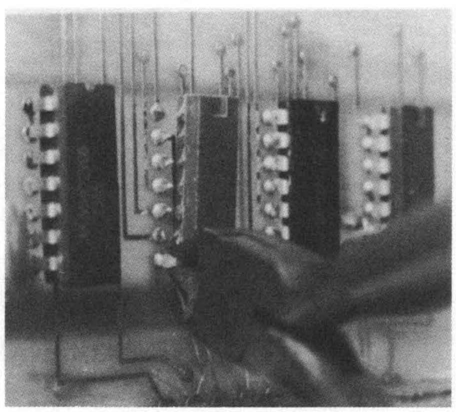


Figure 1. "Clip Out Method." Each lead is cut off as close to the body of the component as possible.

Vacuum Device

Another method removes the IC intact. Unsolder each lead of the IC by heating it on one side and using the soldersucker on the other side (see Figure 3). When the IC lead goes through a plated-through-hole, it must be completely dislodged. This is accomplished, after unsoldering by wiggling each lead gently with long nose pliers. A distinctive click will be heard as the lead breaks free. Any lead that cannot be wiggled is still soldered to the plated-through-hole and must again be unsoldered. Reheat that lead and add new solder, then again apply the soldersucker. Now try again to wiggle the lead with the long nose pliers. Care must be used not to overheat the board. Too much heat in one spot on the PC board will cause spots, referred to as

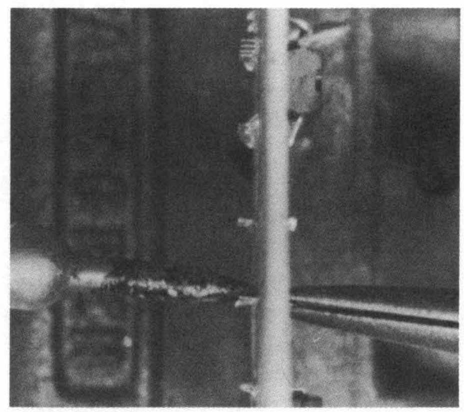


Figure 2. The leftover pins are removed with soldering iron and needle-nose pliers. A little new solder applied to the connection will improve the heat transfer and make the pin easier to remove.

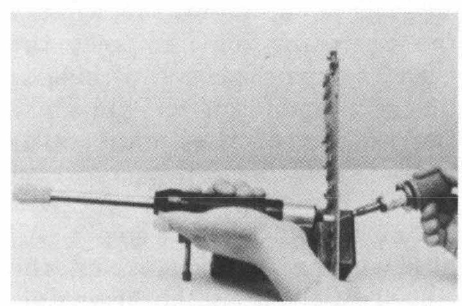


Figure 3. Excess solder is removed from the holes with a hand-operated vacuum device. A little new solder applied to the connection will cause a quicker flow and make the solder easier to remove.

"measling." After all the leads are free, the IC should easily lift off the board.

Care must be exercised in selecting the right soldersucker. A plastic-barreled unit can produce static potentials in excess of 5 kV—more than enough to damage most IC devices. It is also possible for the soldersucker to release lead dust that poses a health hazard to the operator. The source of the exposure can be an unfiltered vent port (the hole located in the upper portion of the barrel), or a defective o-ring seal between the piston and cylinder. If the o-ring deteriorates, solder dross (containing lead) can migrate above the piston to where it contaminates the upper portion of the cylinder. When the piston is activated inside a contaminated cylinder, a small amount of lead may be blown out the vent hole along with air from the piston. Daily cleaning, lubricating and inspection of the o-ring seal should help alleviate this problem.

Desoldering System

A more elaborate and efficient tool for removing ICs is called a desoldering station. This is a temperature controlled soldering iron with a hollow tip connected to a vacuum pump. Appropriate filtering, temperature control and ease of handling and cleaning make this an attractive addition to the technician's bench—especially at a board repair station. One of the self-contained systems we are using is a PACE MBT-100 MicroBenchTop™ desoldering station. (See Figure 4; Note that the soldering iron and holder shown on top of the station is not part of the PACE system.) The basic desoldering principle of this type system is shown in Figure 5. The idea is to place the temperature controlled hollow tip over the lead making contact with the solder. As the solder melts, allow the tip to rest on a film of solder between the pad and tip. Move the tip with a stirring motion until the lead is free and the solder is completely melted. Then, keeping the tip in motion, apply the vacuum and suck the melted solder from the plated-thru-hole. One word of caution though, don't press down on the pad or you'll suck it off the board. Continue the stirring action and vacuum flow for a moment to cool the joint area.

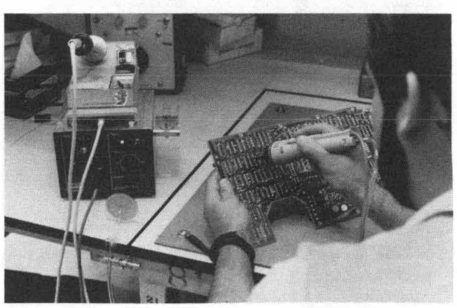


Figure 4. PACE MBT-100 MicroBenchTop™ desoldering station. Note that the soldering iron and holder shown on top of the station are not part of the PACE system.

™ PACE, Inc. 9893 Brewers Ct. Laurel, MD 20707

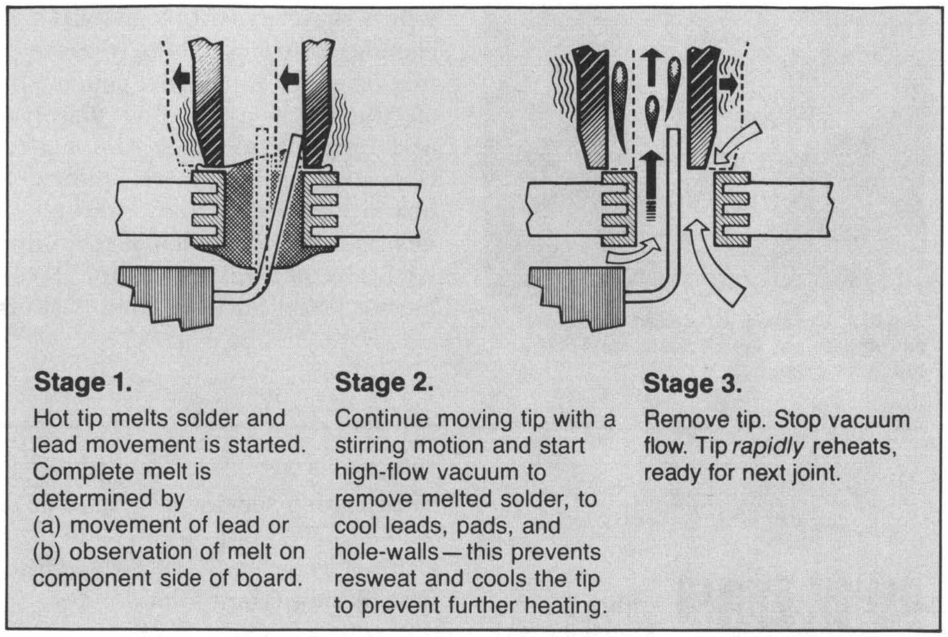


Figure 5. Continuous vacuum desoldering principle.

After all the leads are unsoldered, check each one with your long nose pliers. Any lead that cannot be wiggled is still soldered and must again be unsoldered. As before, resolder the lead and then go through the extraction process again. Allow the joint to cool between resoldering and extraction.

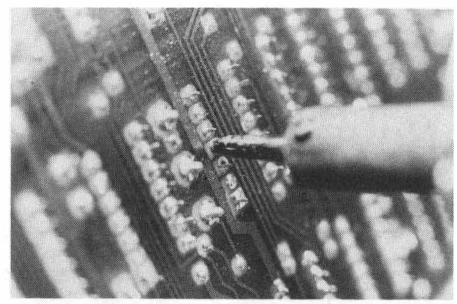


Figure 6. Each IC lead is unsoldered quickly and efficiently with the hot tip/high vacuum tool.

Installation and Cleaning

After the defective IC is removed and the holes are cleaned, install the new IC. Before you solder it into place, double check the orientation. It is most embarrassing to complete the soldering operation only to realize that the IC is installed backwards. As you solder the new IC in place, be certain to get each pin hot enough so solder flows up into the plated-through-hole. Some technicians suggest soldering the lead from both sides of the board.

As far as cleaning, we don't recommend it. Solder flux from RMA-P2 solder does no harm if left in place on a PC board after a hand soldering operation; the rosin is inert and nonconductive. However,

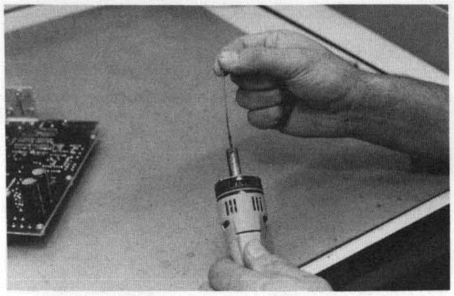


Figure 7. In case the isolated hot solder path clogs, use the enclosed round wire brush for cleaning.

when you dissolve it with a chemical, attempting to remove it from the board, it is like pouring oil on water; the rosin flux dissolves and spreads all over the board, releasing its activators (chlorides, bromides, etc.). Now instead of having a harmless blob of rosin flux with the activators trapped, you have a potential time bomb ticking away. The activators are water soluble. If the instrument is stored in a humid environment, all it takes is a little time and moisture to start the corrosion process. For more information on PC board rework, repair and cleaning, write to the editor and ask for Bench Briefs issue 5952-0111. □

---

supplement to BENCH BRIEFS SERVICE NOTE INDEX

Need Any Service Notes?

They're free!

Here's the latest listing of service notes. They recommend modifications to Hewlett-Packard instruments to increase reliability, improve performance, or extend their usefulness.

Use the order form at the rear of *Bench Briefs* to order, free of charge, individual service notes documenting several instruments.

If you would like to purchase large quantities of service notes covering a wide range of instruments, or if you desire a complete history of all service notes documenting all changes to your instruments, Hewlett-Packard offers a microfiche library for a modest, one time charge. There is also a microfiche subscription service available that automatically updates the library on a quarterly schedule.

The part numbers for the service note microfiche library and subscription service are:

Library— 5951-6511
Subscription service— 5951-6517

Contact your local HP Sales Office for ordering information.

GENERAL

5083-12. End of support for cathode ray tubes used in 1331A/C and 1208A/B instruments, all options.
5083-14. End of support for cathode ray tubes used in 1710B, 1712A, 1720A & 1720AF instruments, all options cathode ray tube part numbers 5083-4052 & 5083-4070.

HP 181A/181AR OSCILLOSCOPES

181A/AR-12. 181A serial prefix 1324A and below; 181AR serial prefix 1337A and below. Recommended replacement for the A6 pulse board assembly.

HP 436A POWER METER

436A-9. All serials. HP-IB verification program for HP 9836 controller.

HP 438A POWER METER

438A-2. All serials. Rear panel input (option 002) retrofit instructions.

HP 1347A HP-IB DISPLAY

1347A-3. All serials. Instructions on segmenting the memory in the 1347A.

HP 1630A/D/G, 1631A/D LOGIC ANALYZERS

1630A/D/G-1/1631A/D-1. Serial prefix: 1630A/D, 1631A/D below 2512A; 1630G below 2513A. Change to the power-up master reset circuit to improve performance.

HP 3065 BOARD TEST SYSTEM

3065-23. All serials. Check for possible miswired DSDC internal cable.
3065-24. All serials. ASRU 2410 firmware bug workaround.
3065-25. Serials 2310A00364 and below. Power module to monitor card cable miswiring.

HP 3336A/B/C SYNTHESIZER/LEVEL GENERATOR

3336A/B/C-10. All serials. Relay cleaning procedure.
3336A/B/C-14. 3336A serials 1930A00987 and below; 3336B serials 1931A01735 and below; 3336C serials 1932A00667 and below. Transistor mounting modification to prevent intermittent resets and erroneous front panel displays.
3336A/B/C-15. 3336A serials 1930A01115 and below; 3336B serials 1931A02240 and below; 3336C serials 1932A00850 and below. Recommended replacement 30 MHz reference crystal.

HP 3467A LOGGING MULTIMETER

3467A-6. Serials 1821A01214 and below. Improved common mode rejection of input amplifier.

HP 3488A SWITCH/CONTROL UNIT

3488A-2. Serials 2240A01857 and below. Improved case for the HP 3488A.

HP 3561A DYNAMIC SIGNAL ANALYZER

3561A-4. 03561-66570 pulse width control assembly. How to properly identify current sensing inductor A70T600.
3561A-5. 2338A01370 and below. Modification to revision C A50 assembly to make built-in diagnostic test routines 150, 151, and 152 operable.
3561A-6. All serials with option 001 bubble memory. New bubble module package.
3561A-7. All serials with option 001 bubble memory modification to prevent error return code – 1 5 29989 00368342.

HP 3711A IF/BB TRANSMITTER

3711A-0. Service note index.

HP 3712A IF/BB RECEIVER

3712A-0. Service note index.

HP 3715 BB TRANSMITTER

3715A-0. Service note index.

HP 3730B DOWN CONVERTER

3730B-0. Service note index.

HP 3737B RF MODULE

3737B-0. Service note index.

HP 3738B RF MODULE

3738B-0. Service note index.

HP 3739B RF MODULE

3739B-0. Service note index.

HP 3743A IF AMPLIFIER

3743A-0. Service note index.

HP 3746A SELECTIVE LEVEL MEASURING SET

3746A-0. Service note index.
3746A-14. All serials. Preferred replacement for A41E1 crystal oscillator.
3746A-15. Serials 2410U-00602 and below. Inspection for short circuit between motherboard casting.

HP 3757A 8.5 MHz ACCESS SWITCH

3757A-0. Service note index.

HP 3762A DATA GENERATOR

3762A-0. Service note index.

HP 3763A ERROR DETECTOR

3763A-11. Options 201, 202, 330. Preferred replacement for A3Q5 and A3Q6.

HP 3764A DIGITAL TRANSMISSION ANALYZER

3764A-10. All serials. Printer retrofit kit.
3764A-11. All serials. Tape cassette retrofit kit.

HP 3776A/B PCM TERMINAL TEST SET OPTION 001

3776A-18A. Serials 2444U00292 and below. Frequency update instructions for data measurement option 001.

3776A-20A. Serials 2444U00292 and below. Modification to make old assembly 03776-60008 compatible with firmware rev 2501.

3776A-21. All serials. 3776 test programs data cartridge (HP part number 03776-10001) modifications – update to rev C.

3776B-18A. Serials 2437U00642 and below. Frequency update instructions for data measurement option 001.

3776B-21. All serials. 3776 test programs data cartridge (HP part number 03776-10001) modifications – update to rev C.

HP 3779A/B PRIMARY MULTIPLEX ANALYZER

3779A-36. All serials. Preferred replacement for transistors Q4 and Q8 on the A29 assembly.

3779B-38. All serials. Preferred replacement for transistors Q4 and Q8 on the A29 assembly.

3779B-39. All serials. Preferred ROM U31 and U41 replacement on the A24 assembly.

HP 3779C/D PRIMARY MULTIPLEX ANALYZER

3779C-21. Serials 309 to 403. Improved return loss measurement performance.

3779C-22. Serials 458 and below. Preferred replacement for assemblies A23, A24, A25 and A26.

3779D-25. Serials 244 to 333. Improved return loss measurement performance.

3779D-26. Serials 438 and below. Preferred replacement for assemblies A23, A24, A25 and A26.

HP 3780A PATTERN GENERATOR/ERROR DETECTOR

3780A-30. Options 100 and 101. Preferred replacement for A13Q5 and A13Q6.

HP 3782A ERROR DETECTOR

3782A-5. All serials. Preferred replacement for A32Q12 and A32Q13.

HP 3785A/B JITTER GENERATOR & RECEIVER

3785A-14. All serials. Retrofit instructions for option 062.

3785A-16. All serials. Preferred replacement for A11U33.

3785B-13. All serials. Retrofit instructions for option 062.

HP 4062A SEMICONDUCTOR PARAMETRIC TEST SYSTEM

4062A-5. All serials. Installation information for the 16294A field upgrade kit.

HP 4274A MULTI-FREQUENCY LCR METER

4274A-26. Serials 2434J02741 and below. Bias circuit modification for new replacement FET.

HP 4937A TRANSMISSION IMPAIRMENT TEST SET

4937A-1. Serials 2418 and below. Modification to improve the hold circuit.

HP 4938A NETWORK CIRCUIT ACCESS TEST SET

4938A-1. Serials 2450A and below. Corrected REN-3 load.

HP 4944A TIMS

4944A-12A. Serials 2027A00899 and below. Self check failures under cool/damp conditions.

HP 4945A TIMS

4945A-1. Serials 2435A and below. Modification to prevent power supply regulators from shorting to chassis.

4945A-2. Power supply modification to improve performance.

4945A-3. Serials 2435 and below. Software upgrade rev 2.0.

4945A-4. Service kit modification.

HP 4951A PROTOCOL ANALYZER

4951A-7. Serials 2443A02576 and below. SCC retrofit kit.

4951A-9. All serials. Final test procedure.

4951A-10. Serials 2443A and below. Software revision 2.0.

HP 4953A PROTOCOL ANALYZER

4953A-1. Serials 2441A00326 and below (see table in contents of note). Modification to fix handle mounting rails.

4953A-2. Serials 2441A and below prefix (see table in contents of note). Power supply modification to improve performance.

4953A-3. Serials 2441A and below (see table in contents of note). 2.1 firmware update.

4953A-4. Serials 2441A00291 and below (see table in contents of note). A6 and A19 memory board U707 IC change.

HP 5328A/5328AH99 UNIVERSAL COUNTER

5328A-41. All serials for the 5328A; serials 2424 and below for the 5328AH99. Modification to turn off the fan in standby mode.

HP 5328B UNIVERSAL COUNTER

5328B-2. Serials 2424 and below. Modification to turn off the fan in standby mode.

HP 5342A MICROWAVE FREQUENCY COUNTER

5342A-42. Serials 2440A09236 and below. Modification to prevent high frequency miscount.

5342A-43. Serials 2428A8916 to 2440A9306. Recommended IC replacement to prevent miscounts.

HP 5343A MICROWAVE FREQUENCY COUNTER

5343A-21. Serials 2428A1736 to 2440A1956. Recommended IC replacement to prevent miscounts.

HP 5345A ELECTRONIC COUNTER

5345A-26. Serials 2242A10310 and below. Instructions to retrofit a standard HP 5345A to option 012 (original version front end).

5345A-27. Serials 2242A10311 and above. Instructions to retrofit a standard HP 5345A to option 012 (new version front end).

HP 6011A SYSTEM POWER SUPPLY

6011A-1. Serials 2530A00211 and above. Modification to increase reverse voltage protection.

HP 6012A SYSTEM POWER SUPPLY

6012A-6. Serials 2426A02636 thru 2426A2891 and 2426A02910. Recommended meter replacement.

HP 6031A SYSTEM POWER SUPPLY

6031A-2. Serials 2508A00243 and above. Modification to increase reverse voltage protection.

HP 6942A AND 6944A MULTIPROGRAMMERS

6942A-10/6944A-1. All serials. Field support kit description.

HP 7090A MEASUREMENT PLOTTING SYSTEM

7090A-2. Serials 2418A & 2430A. Design changes to 7090A power supply PCA.

HP 8111A PULSE/FUNCTION GENERATOR 20MHz

8111A-2. All serials. New dual transistor part-number.

HP 8116A PULSE/FUNCTION GENERATOR 50 MHz

8116A-1A. Serial 2124G: serials 2334A00224 and below. Modification of the output amplifier.

8116A-2. All serial numbers. New dual transistor part-number.

HP 8165A PROGRAMMABLE SIGNAL SOURCE

8165A-11. All serials. New dual transistor part-number.

HP 8405A VECTOR VOLTMETER

8405A-10A. Serials 732A and above. Precautions to prevent damage when handling 8405A probes.

HP 8620C SWEEP OSCILLATOR

8620C-9. Serials 2252a and below. Fan assembly and operation control assembly replacement kit.

HP 8662A SYNTHESIZED SIGNAL GENERATOR

8662A-12. Serials 2424A and below. Modification to improve low frequency loop performance and eliminate intermittent status errors 03/04.

8662A-13. Serials 2509A and below. Modification to prevent fuse blowing during power up in 230VAC mode.

HP 8663A SYNTHESIZED SIGNAL GENERATOR

8663A-7. Serials 2507A and below. Modification to prevent fuse blowing during power up in 230VAC mode.

HP 8673B/C/D SYNTHESIZED SIGNAL GENERATOR

8673B-2. Serials 2447A and below. Firmware update kit.

8673C-2. Serials 2452A and below. Firmware update kit.

8673D-2. Serials 2449A and below. Firmware update kit.

HP 8684B SIGNAL GENERATOR

8684B-2. All serials. Power amplifier oscillation troubleshooting hint.

HP 10004D, 10005D, 10006D, 10013A, 10014A AND 10016B 10:1 VOLTAGE DIVIDER PROBES AND HP 10007B AND 10008B VOLTAGE PROBES (PASSIVE)

100XXA/B/D-1. Possible probe accessory tips shorting to ground internally.

HP 11729B CARRIER NOISE TEST SET

11729B-3. Serials 2345A and below. Modification to improve A7C5/C8 reliability.

HP 64100A LOGIC DEVELOPMENT STATION

64100A-14. Serials 2210A thru 2336A, all 64100 to 66524 and 69524 rear panel boards. Modification to prevent intermittent system bus failures.

HP 64610S HIGH SPEED TIMING/STATE ANALYZER

64601B-1. All serials. 125 MHz time state module calibration procedure.

HP 69791A AND 69792A HIGH SPEED MEMORY CARDS

69791A-1/69792A-1. All serials. Documentation corrections for memory card verification routines.

HP 86601A RF SECTION PLUG-IN

86601A-9. Serials 2437A and below. Modification to improve reliability of A13 attenuator assembly.

HP 86602B RF SECTION PLUG-IN

86602B-4. Serials 2437A and below. Modification to improve reliability of A13 attenuator assembly.

HP 86603A RF SECTION PLUG-IN

86603A-6. Serials 2446A and below. Modification to improve reliability of A13 attenuator assembly.

Service Note Order Form

If you want service notes, please check the appropriate boxes below and return this form separately to one of the following addresses.

Hewlett-Packard
1820 Embarcadero Road
Palo Alto, California 94303

For European customers (ONLY)

Hewlett-Packard
Central Mailing Dept.
P. O. Box 529
Van Hueven Goedhartlaan 121
AMSTELVEEN—1134
Netherlands

Name ______________________

Firm ______________________

Address ______________________

City ______________________

State ____________ Zip ____________

☐ 181A/AR-12	☐ 3730B-0	☐ 3779B-39	☐ 4951A-9	☐ 8111A-2
☐ 436A-9	☐ 3737B-0	☐ 3779C-21	☐ 4951A-10	☐ 8116A-1A
☐ 438A-2	☐ 3738B-0	☐ 3779C-22	☐ 4953A-1	☐ 8116A-2
☐ 1347A-3	☐ 3739B-0	☐ 3779D-25	☐ 4953A-2	☐ 8165A-11
☐ 1640A/D/G-1/1631A/D-1	☐ 3743A-0	☐ 3779D-26	☐ 4953A-3	☐ 8405A-10A
☐ 3065-23	☐ 3746A-0	☐ 3780A-30	☐ 4953A-4	☐ 8620C-9
☐ 3065-24	☐ 3746A-14	☐ 3782A-5	☐ 5083-12	☐ 8662A-12
☐ 3056-25	☐ 3746A-15	☐ 3785A-14	☐ 5083-14	☐ 8662A-13
☐ 3336A/B/C-10	☐ 3757A-0	☐ 3785A-16	☐ 5328A-41	☐ 8663A-7
☐ 3336A/B/C-14	☐ 3762A-0	☐ 3785B-13	☐ 5328B-2	☐ 8673B-2
☐ 3336A/B/C-15	☐ 3763A-11	☐ 4062A-5	☐ 5342A-42	☐ 8673C-2
☐ 3467A-6	☐ 3764A-10	☐ 4274A-26	☐ 5342A-43	☐ 8673D-2
☐ 3488A-2	☐ 3764A-11	☐ 4937A-1	☐ 5343A-21	☐ 8684B-2
☐ 3561A-4	☐ 3776A-18A	☐ 4938A-1	☐ 5345A-26	☐ 100XXA/B/D-1
☐ 3561A-5	☐ 3776A-20A	☐ 4944A-12A	☐ 5345A-27	☐ 11729B-3
☐ 3561A-6	☐ 3776A-21	☐ 4945A-1	☐ 6011A-1	☐ 64100A-14
☐ 3561A-7	☐ 3776B-18A	☐ 4945A-2	☐ 6012A-6	☐ 64601B-1
☐ 3711A-0	☐ 3776B-21	☐ 4945A-3	☐ 6031A-2	☐ 69791A-1/69792A-1
☐ 3712A-0	☐ 3779A-36	☐ 4945A-4	☐ 6942A-10/6944A-1	☐ 86601A-9
☐ 3715A-0	☐ 3779B-38	☐ 4951A-7	☐ 7090A-2	☐ 86602B-4
				☐ 86603A-6

Please photocopy this order form if you do not want to cut off the page.

HEWLETT-PACKARD COMPANY
1820 Embarcadero Road
Palo Alto, California 94303

BENCH BRIEFS
MARCH-MAY 1985
Volume 25 Number 2

Service information from Hewlett-Packard Company

To obtain a qualification form for a free subscription, send your request to the above address.

Reader comments or technical article contributions are welcomed. Please send them to the Bench Briefs Editor.

Editor: Jim Bechtold
Hewlett-Packard
690 E. Middlefield Rd.
Mt. View, CA 94042

Bulk Rate
U.S. Postage
PAID
Sunnyvale, CA.
Permit No.
804

Printed in U.S.A.